



Digital Transformational Leadership: Its Effect on Digital Services and Literacy in Elementary School

Ali Imron^{1*}, Primardiana Hermilia Wijayati¹, Syamsul Hadi¹, Kamilatun Nisa¹, Amelia Dwi Lestari¹

¹ Faculty of Education State University of Malang, Malang, Indonesia

*ali.imron.fip@um.ac.id ; primardiana.hermilia.fs@um.ac.id ;
syamsul.hadi.ft@um.ac.id ;
kamilatun.nisa.2101328@students.um.ac.id ;
amelia.dwi.2101316@students.um.ac.id

Abstract. The call for digital transformation in educational institutions, including elementary schools, has long been made since the disruption swept the business world and many aspects of life worldwide. Meanwhile, digital transformation requires leaders who can initiate the process, manage it, and serve as the central pawns to drive the outcome of the process. This research uses an explanatory survey design with the analysis technique SEM PLS. Data acquisition was from June 10th, 2023, until October 11th, 2023. The findings show that LD directly impacts both KKT (3.684) and SKT (2.460), while PD also directly influences both KKT (8.261) and SKT (9.210). The analysis also indicates that KKT and SKT enhance AKT with t values (4.685) and (1.737). The findings of this study can be used as policy inputs in the transformational digital leadership of school principals to accelerate digital services and literacy in primary schools. Given that teachers and principals were also involved in this study, it is recommended that they also supervise and implement this model in their respective schools. Since what this research produces has a novelty that enhances earlier research findings, education management scientists can use it as input, a reference, and a stepping stone for future research.

Keywords: digital transformational leadership, digital literacy, digital services, school principal leadership.

1 Introduction

There is concern that the upheaval plaguing business and industry will also impact academic institutions. Consequently, several organizations have pushed for the digital transformation of educational establishments, including elementary schools, to ensure their survival in extraordinarily rapid change. The pressure increased as almost every nation on the planet was impacted by the Covid-19 pandemic. Although there is a growing awareness of the benefits of digitizing services, many educational institutions—particularly elementary schools—continue to face challenges in actual implementation. The leader himself is one of the main obstacles. Leaders have the most control over how quickly services are rendered and how well students understand technology.

School principals must practice digital leadership to anticipate possible problems and prepare teachers for the eras of the Industrial Revolution 4.0 and Society 5.0. The role of leadership is crucial, particularly the kind of leadership appropriate for the current era—the digital era. Of course, digital leadership is the kind of leadership that is

appropriate for the digital age. The qualities of agility, speed, "aggressiveness," and the capacity to adjust to frequently abrupt and unexpected changes are unique to digital leadership [1-3]. School organizations need to change with the times and be flexible as well. Their leaders must be bold, creative, and unorthodox if they are to ensure their survival.

Technology-related activities and the principal's digital leadership are inextricably linked, particularly regarding organizational decision-making, policy, and technology implementation [4]. According to the International Society for Technology in Education, or ISTE, there are five constructs related to digital leadership: digital citizenship, transformational leadership, excellence in professional practice, digital learning culture, and systemic improvement [5].

It has been discovered that using information technology in education, learning, and digital communication can enhance student achievement. Digital technology has allowed for the replacement of face-to-face personal communication with personal communication[6]. The digital era of information technology necessitates cooperation between human and technological capabilities through big data analytics, machine and human interconnection, self-learning algorithms, and mobile self-driving[7]

The COVID-19 emergency has passed, and practically all nations can now effectively manage it. This includes educational institutions that offer services to multiple stakeholders. The emergency forced students to miss class as usual, which compelled almost all academic institutions to transition from manual to digital services. To implement learning during a pandemic, the Indonesian government issued a Joint Decree (known as SKB) of Four Ministers through the Ministry of Education and Culture. This decree was the foundation for transitioning from an offline, face-to-face learning model to an online, virtual, in-network learning model [8]. The SKB of 4 ministers in schools guides implementing online learning that requires information technology.

Due to developments in digital technologies such as cloud computing, artificial intelligence, big data analytics, and the Internet of Things (IoT), digital transformation is essential in the COVID-19 era and beyond. However, it may also cause unprecedented disruptions in societies, industries, and organizations [9]. Because of this, the phrase "digital transformation" has since been used to refer to modifications made to an organization's working environment or the roles, responsibilities, and services it provides due to digital technology[10]. The reorganization of social life in digital media and communication infrastructure is known as digitalization, and it will eventually affect educational institutions, particularly elementary schools [11].

The education sector is irreversibly going digital because it will be able to support learning that will help teachers and students deal with medical emergencies brought on by the COVID-19 pandemic [12]. With the efforts to contain the pandemic, rapidly evolving digital technologies have great potential to be important in the post-epidemic future. Developing a digitally-compatible governance paradigm post-COVID-19 is essential to establishing digitally-led governance as the standard in the digital society [13]. Organizations must adapt their organizational management to stay relevant and competitive, as those who resist change put themselves at risk of failing [14].

It is critical for educational institutions, particularly elementary schools, to digitize their services. In the digital age, new roles about the digitalization of services are necessary for the principal of a school to fulfill their role as an educational leader. School

principals must take on digital leadership roles due to the shift in elementary school students' literacy from reading, writing, and math (known as calistung in Indonesia) to technological, human, and digital literacy in response to 21st-century demands. Therefore, it is appropriate to thoroughly analyze the principal's digital leadership model to advance service and digital literacy in elementary schools.

2 Methods

To accelerate digital literacy and digital services, the research employs a quantitative research approach with a survey-explanation research design to examine the traits and elements that define the constructs of transformational digital leadership. Data acquisition was conducted from 10 June 2023 to 11 October 2023. These involved respondents selected from various Indonesian institutions filling out a self-reported questionnaire. Although there is still much to be written about the characteristics of transformational digital leadership, a thorough review of the literature and an investigation into leadership implementation measures from [15] made it easier to identify the fundamental qualities of a digital leader and create the survey questions. Many characteristics were mentioned in the literature, but the scholars' selection lacked theoretical support and reasoning.

Consequently, this study aimed to group the traits and actions according to their functions into several dimensions. Teachers and principals were the intended respondents. Physical visits and intensive communication via phone calls, emails, WhatsApp, and social media were used to gather completed surveys.

2.1 Confirmatory Factor Analysis

Only items with a loading factor greater than 0.75 were chosen to perform the CFA. Every single item from the first five variables. Following the reduction of items (loading < 0.75), a model was created and sent to CFA for testing. Smart PLS was utilized for testing the CFA model. This was chosen because it yields chi-square test statistics and standard errors resistant to deviations from normalcy.

Initially, we examined how well the model fit the data. The standardized root mean square residual (SRMR), the relative chi-square test, and the normed fit index (NFI) were the six fit indices employed.

Table 1. Fit Indices for CFA Models

Goodness of Fit Indices		
NFI	SRMR	X ² Chi-Square
0.912	0.091	11678.54

The goodness of fit indices was found to be acceptable, as shown in Table 1. Based on Table 1, it can be seen that all indices are within the recommended criteria, namely $\chi^2 = 11678.540$; SRMR = 0.091; and NFI = 0.912.

2.2 Validity of Transformational-Digital Leadership Model

Convergent and discriminant validity comprise the construct validity that is tested to assess the validity of the measurement model. Confirmatory Factor Analysis assesses the model's convergent validity (CFA). The test includes indicators with a loading value greater than 0.75 [16], and a minimum AVE size of 0.5 is needed. Composite Reliability

(CR), which each must surpass (>0.70), is the basis for evaluating reliability. The results of both discriminant validity and convergent validity are shown in Table 2.

Table 2. Fit Indices for CFA Models

Latent Variables			Discriminant Validity				
	AVE	CR	1	2	3	4	5
AKT	0.676	⁰ .982	⁰ .822				
KKT	0.632	⁰ .983	⁰ .788	⁰ .795			
LD	0..682	⁰ .979	⁰ .851	⁰ .710	⁰ .826		
PD	0.619	⁰ .936	⁰ .829	⁰ .807	⁰ .720	⁰ .787	
SKT	0.614	⁰ .941	⁰ .726	⁰ .835	⁰ .653	⁰ .773	⁰ .783

a.

AKT-Digital Service Acceleration, KKT- Digital-Transformational Leadership Skills, LD- Digital Literacy, PD- Digital Services, SKT- Digital-Transformational Leadership Syntax

According to the discriminant validity principle, measures of distinct constructs shouldn't have a strong correlation with one another. The acceptable index states that the square root of AVE should be greater than the correlation coefficient between other variables and latent variables. Table 2 shows that the square root value of the AVE is larger than the correlation coefficient between the constructs, indicating that the measurement model achieves good discriminant validity.

A construct's discriminant validity refers to how much it differs from other constructs. In accordance with [17], we determine whether the four factors are distinct by comparing the square root of the AVE for any two factors to the correlation between those two factors. Table 2's results demonstrate this; from this, we can infer that four factors have unique characteristics that capture various facets of roles.

2.3 Structural Model Interpretation

Based on the evaluation of the measurement model described earlier, the next stage, according to the research objectives, is to test the effect of digital service type variables and digital literacy types on digital service acceleration by school principals, with digital-transformational leadership variables (digital-transformational leadership syntax and skills) as mediating variables. The next step is to interpret the model. Figure 1 shows the results of SEM testing using the SmartPLS 3.0 application. The results of hypothesis testing and a summary of the total effect, namely both direct and indirect effects of exogenous variables on endogenous variables, can be seen in Table 3.

Fig. 1. Structural Model Output

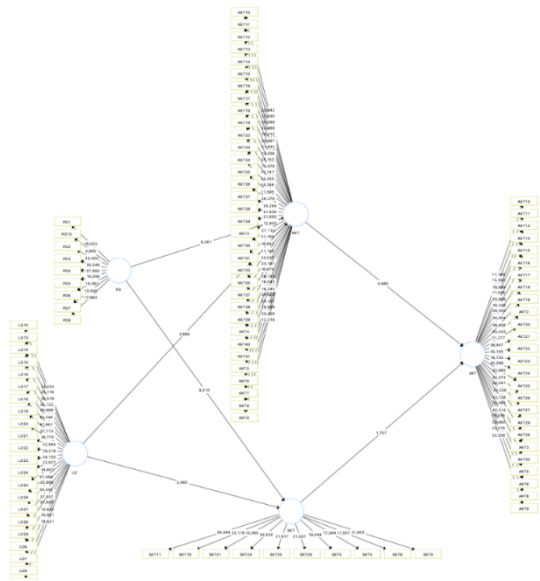


Table 3. direct and indirect effects

Relationship		p	T Statistics	Decision	
KKT	AKT	0,000	4,685	H ₁	
				Accepted, Declined	H ₀
LD	KKT	0,000	3,684	H ₁	
				Accepted, Declined	H ₀
LD	SKT	0,014	2,460	H ₁	
				Accepted, Declined	H ₀
PD	KKT	0,000	8,261	H ₁	
				Accepted, Declined	H ₀
PD	SKT	0,000	9,210	H ₁	
				Accepted, Declined	H ₀
SKT	AKT	0,083	1,737	H ₁	
				Declined, Accepted	H ₀

a. AKT-Digital Service Acceleration, KKT- Digital-Transformational Leadership Skills, LD- Digital Literacy, PD- Digital Services, SKT- Digital-Transformational Leadership Syntax

Based on Table 3 and Figure 1, the interpretation of the analysis results is as follows

- Digital-transformational leadership skills (KKT) have a direct relationship with the principal's digital service acceleration (AKT) because the p-value is 0.000 (<0.050). The C.R value is 4.685 (>1.96), meaning statistically that the higher the application of digital- transformational leadership skills, the more the types of digital services principals in elementary schools can accelerate.

- The type of digital literacy (LD) has a direct relationship with digital-transformational leadership skills (CTL) because the p-value is 0.000 (<0.050). The C.R value is 3.684 (>1.96), meaning statistically that the higher the type of digital literacy in schools, the more the digital-transformational leadership skills of principals in primary schools increase.
- Digital literacy type (LD) has a direct relationship with digital-transformational leadership syntax (SKT) because the p-value is 0.014 (<0.050) and the C.R value is 2.460 (>1.96), meaning statistically that the higher the digital literacy type in schools, the more the digital-transformational leadership syntax of principals in primary schools increases.
- Types of digital services (PD) have a direct relationship with digital-transformational leadership skills (KKT) because the p-value is 0.000 (<0.050) and the C.R value is 8.261 (>1.96), meaning statistically that the types of digital services in schools, the higher the digital-transformational leadership skills of principals in primary schools.
- Types of digital services (PD) have a direct relationship with digital-transformational leadership syntax (SKT) because the p-value is 0.000 (<0.050) and the C.R value is 9.210 (>1.96), meaning statistically that the more types of digital services in schools, the higher the digital-transformational leadership syntax of principals in primary schools.
- Digital-transformational leadership syntax (SKT) has no relationship with principals' digital service acceleration (AKT) because the p-value is 0.013 (<0.050). The C.R value is 5.737 (>1.96), meaning statistically that the higher the application of digital-transformational leadership syntax of principals, the no effect on the types of digital services that principals can accelerate in elementary schools.

3 Discussion

Primary school principals' digital-transformational leadership syntax in school quality improvement as a form of principal steps needed by primary schools in the digital era. A top priority in education is the principal's actions in the digital transformation of the school system, and digital content will be crucial to its success. Teachers and principals must acquire digital competencies, and the principal's influence will be critical to adequate and appropriate digitization. Principals can impact the pedagogical approach employed in schools through their leadership and knowledge of the educational context. This is crucial for promoting teacher empowerment and enhancing students' learning outcomes.

This can be understood because, in line with [18], principals' leadership can facilitate digital cultural transformation, not through authority or bureaucratic influence, but rather through their ability to encourage open debate that allows the education community to see digital services into the pedagogical model as an opportunity for improved outcomes. In another study by [19], principals who are competent in applying digital transformational leadership can improve school services according to the school's suitability and the situation's needs.

These fifteen key themes—"honesty, humility, courage, ethical AI, growth mindset, transparent agenda, data focus, inspire engagement, storytelling, digital literacy, positive attitude, skills acquisition, knowledge sharing, participative style, and track record"—were identified based on the opinions and experiences of the participants [20], [21]. Another study revealed that principals' digital leadership skills are grouped into technology use, managerial skills, and individual skills [22]. Thus, the use of digital technology, support for digital transformation, support for technology-based professional development, and support for a digital learning culture are underlying in

the types of digital services that principals can accelerate through digital transformational leadership.

This digital service is an effort to provide public services in education, both in the classroom and the managerial field. Digital services in the school refer to various software and hardware intended to assist learning with specific accessibility needs. This implication can later help students to prepare for lifelong learning. Thanks to digital services, students can learn more efficiently and track their progress with the help of advanced technology and equipment [23]. Educational apps and technologies can save a lot of time and energy by automating some of the day-to-day operations in school administration. Thus, this type of digital service in primary schools can be successfully implemented in education to improve the principal's environment and performance through digital transformational leadership.

This type of digital literacy in primary schools is described in seven adapted elements, namely the perceived ability to use and learn digital technology, social influence and support from school institutions, intention and availability to use digital technology, the usefulness of digital technology for teaching and learning, awareness of the limitations of digital technology, understanding of digital-based pedagogical potential, and awareness of how to find help and realize the influence of digital technology. Another study revealed how digital transformational leadership creates a culture of digital literacy in schools, as illustrated by its functions as an educator, manager, administrator, supervisor, leader, innovator, and motivator [24]. Because today's students will be tomorrow's students, school principals make the most of academic staff members in the educational workplace regarding the kinds and standards of digital literacy as a program in the educational curriculum.

Another study showed that there are still significant inequalities in the provision of digital services and the presence of qualified staff with the digital transformational leadership skills needed to enable practical digital media projects to be integrated into everyday learning practices [25]. According to [26], in their qualitative study, digital leadership teams adapt the digital services used to communicate with the school community to match the current global acceleration. Thus, principals must demonstrate the quality of their digital services to improve student's learning conditions through digital transformational leadership.

4 Conclusion

Based on the results of the data analysis, the following conclusions were obtained:

- Implementation of digital transformational leadership syntax by primary school principals significantly affects the types of digital services that principals can accelerate in primary schools.
- The digital transformational leadership skills of primary school principals significantly affect the types of digital services that principals can accelerate in primary schools.
- Types of digital services have a direct relationship and significant effect on digital transformational leadership syntax.
- The types of digital services have a direct relationship with and significant effect on the digital transformational leadership skills of principals in primary schools.

- Types of digital literacy in elementary schools directly and significantly affect digital transformational leadership syntax.
- The types of digital literacy in elementary schools have a direct relationship with and a significant effect on principals' digital transformational leadership skills in elementary schools.
- The types of digital services that school principals can accelerate through digital transformational leadership are influential and very well received by respondents.

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